Title & Detailed Synopsis of the Proposed Ph.D. Thesis

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CHEMICAL STUDIES WITH SOME BIOLOGICALLY RELEVANT ORGANIC COMPOUNDS OF NATURAL ORIGIN

Background: Natural products are classified based upon their origins, biological functions and structures, encompassing a wide variety of chemical compound classes that include alkaloids, antibiotics, terpenoids, flavonoids, xanthonoids, phenolics, carbohydrates, lipids, proteins and amino acids, and nucleic acids. This huge diversity in chemical structures of natural products is an outcome of biosynthetic processes that have been modulated over the millennia through genetic effects. With the advent of modern techniques, particularly the rapid improvements in spectroscopic as well as accompanying advances in high-throughput screening techniques, it has become possible to have an enormous repository of bioactive natural compounds, thus opening up exciting new opportunities in the field of new drug development to the pharmaceutical industry. Medicinal chemistry of such bioactive compounds encompasses a vast area that includes their isolation and characterization from natural sources, structure modification for optimization of their activity and other physical properties, and also total and semi-synthesis for a thorough scrutiny of structure-activity relationships.

Mother Nature has provided us with the cure for many diseases in form of natural products, or the so called secondary metabolites. The plant kingdom, in particular, has already offered a wide diversity of compounds that can serve as exciting new pharmacophores with novel mechanisms of action for controlling disease processes. The challenge to understand nature's magical chemistry is continuously stimulating much of our intellectual thoughts, scientific discoveries, and advances in technology. Plants are producing numerous chemically highly diverse secondary metabolites which are optimized for exerting biological functions and are still far from being exhaustively investigated.

Due to the availability of huge numbers of bioactive natural products, synthetic organic chemistry, computational chemistry, medicinal chemistry, biochemistry and analytical chemistry as well as molecular biology, pharmacognosy, biotechnology, and clinical science have become the major scientific areas in the past few decades. It has been extensively demonstrated that the search for natural products, or products obtained from them through semi-synthesis or synthesis of natural product-inspired molecules, is directed toward identifying new molecules for diseases and investigating their mechanism of actions and their specific targets of interactions.

At this juncture of present-day chemical scenario, the present investigator has received an encouraging stimulus to undertake a dedicated research at this spectacular filed of **plant-derived natural products**.

Objectives: The present proposal aims to undertaking chemical studies of some plant-derived organic compounds of biological relevance isolated from indigenous medicinal plants. The main themes of the proposed research work are as follow:

- Isolation of bioactive natural products from indigenous medicinal plants
- Purification and structural elucidation of the phytochemicals
- Detailed spectroscopic studies of the organic molecules
- Chemical transformations with the phytochemicals in view of preparing semi-synthetic derivatives
- Chemical diversifications of the plant products

Work plan: During the research tenure, the applicant plans to take up dedicated research in the prescribed field as summarized below–

- Identification and collection of plant materials
- Processing of plant materials
- Extract preparation of various plant parts
- Isolation and purification of phytochemicals from varying plant extracts
- Spectroscopic studies and structural elucidation of the isolated phytochemicals
- Chemical studies with the phytochemicals
- Chemical diversifications of the plant products

Methodology: Air-dried powered plant materials will be extracted with 90% ethanol in cold, and then the alcoholic extract as obtained will be concentrated under reduced pressure; the semi-solid mass then will be solvent fractionated successively with hexane, petrol ether, benzene, chloroform, ethyl acetate and water. Each fraction after making concentrated with the help of rotary evaporator will be subjected to column chromatographic resolution using pure and mixture of solvents (low polar to high polar) as eluents. Chromatographic resolution will yield solid mass that would be purified by means of further column chromatography followed by HPLC. Purified phytochemicals will then be subjected to certain chemical tests for their classification (vide ref. J. B. Harborne, Phytochemical Methods, Chapman and Hall, London, 1973, p.33-80.). Structural elucidation will be done on the basis of spectral (elemental analyses, UV, FT-IR, 1H-NMR, ^{13}C-NMR, EIMS, 2D-NMR, HRMS) as well as chemical degradations. Detailed chemistry of each chemical constituent will cover its useful reactions, degradated products, conversion experiments. X-ray crystallographic studies of the phytochemicals will also be considered, where applicable. Chemical transformations of the isolated natural molecules will be performed based on standard synthetic protocols and/or the protocols to be designed accordingly.

Related Literature

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